Indians of all ages have far less expectation of life than Englishmen in England; worse still, the Indian expectation has been diminishing these twenty years while the Englishman's has been increasing. In 1911 an Indian 20 years of age had a life expectation of 27.5 years—one year less than he had in 1901. The Englishman of the same age in the same period had increased his expectation from 41 to 43.7 years.

It is a sad picture. Not all the census figures are sad though. One table shows wages in India between the years 1900 and 1912 rising from 119 to 166, while the average of prices had only risen from 122 to 141. In England in the same period wages rose from 100 to 103 and prices from 100 to 109. Wattal thinks this peculiar though he has no reason to doubt the figures. Another datum that troubles him is the number of people to a house. It has fallen during the last three decades from 5.8 to 5.4, 5.2, and 4.9. Surely that is a gain.

Another comforting fact that the author does not mention is that the census shows Indian population growing at the rate of 2,000,000 a year, 8,000,000 since the book was written, and still it has found subsistence. If the limit of food is near, surely there must be evidence on every hand in India that famines are more frequent and that life is harder than formerly: the author offers none.

However, his main point is beyond doubt. India has too high a birth rate.

MARK JEFFERSON

TOWN PLANNING IN ANCIENT INDIA

C. P. VENKATARAMA AYYAR. **Town Planning in Ancient Dekkan.** With an Introduction by Patrick Geddes. xxi and 199 pp. The Law Printing House, Madras. $2.00. 7 x 5 inches.

A collection of references to town and house construction in the old Tamil writings, with comments by the author. One can hardly say that old Dekkan did any town planning. There were some habitual features. Different arts and trades had streets to themselves. The elephant trainers had broad avenues to exercise their animals. The temple tended to be a central feature; and, except in river towns, there was an ample tank of drinking water containing sufficient water even if the monsoon failed. This was commonly bordered by trees and gardens, in which beauty was prized but "sanitation" was sought—in an oriental way. Punnai trees were planted by the seashore, because this tree grows "in sandy soil. Its smell keeps off the bad odours of fish." Trees bearing nutgalls were valued for planting alongside the water tanks because the tannin in their fruit gives a "slightly sweet taste to the water and thus masks any excess of chlorine in drinking water."

MARK JEFFERSON

VOLCANOES OF EASTERN BALI

G. L. L. KEMMERLING. **De Vulkanen Goenoeng Batoer en Goenoeng Agoeng op Bali.** Maps, diagrs., ills. *Jaarboek van het Mijnwezen in Nederl. Oost-Indië,* Vol. 46, 1917, Part I, pp. 50–77. Batavia.

Kemmerling's account of the two volcanoes on Bali is preceded by a study in the same yearbook (pp. 1–48) of a destructive earthquake by which the southern side of that beautiful island was visited in January, 1917. It may be here noted briefly that the earthquake had an undulatory motion and is ascribed, not to volcanic action, but to structural deformation between the up-raised chain of islands and the deep floor of the adjacent Indian Ocean. It is reported that 74,000 buildings, or 90 per cent of the total number, were overthrown or injured, 1,358 persons were killed, and 1,060 wounded. Great damage was done by landslides, of which a number of good views are given, in unconsolidated volcanic deposits on the sides of ravines and on the inner ring-wall slope of the Batur (Batoer) caldera.

Both the volcanoes described are in the eastern part of Bali. Gunung (Mount) Agung, or the Peak of Bali, is a fine young cone of regular form, 3,142 meters in altitude, with a summit crater ½ kilometer in diameter; the long exterior slopes, largely built of lavas, are little dissected. The Gunung Batur mass, farther west, is much more complex. It consists primarily of the remains of a great cone, the top of which has broken down to caldera form, but the caldera is now more or less filled with the products of later eruptions; the down-wash of recently erupted material from the exterior slopes of the remnant cone has largely contributed to the aggradation of the piedmont lowlands. The caldera bears the marks of two engulfments; the earlier one produced a ring wall of elliptical outline, 13.8 and 10 kilometers

in diameter, and varying in altitude from 1,267 to 1,745 meters, the highest point being on the north. The inward slope of the wall, probably much decreased by fragmental materials from later eruptions, leads by a gentle declivity to a caldera floor about 1,400 meters in altitude on the north but less on the south. The later engulfment produced a smaller circular caldera, 7 kilometers in diameter, in the floor of the earlier one; steep walls, 200 or 300 meters high and more or less ravined, separate the two. So much as now remains of the earlier floor, or Kintamani terrace, is of over-crescentic, or horseshoe, form, narrowest southwards, as the later caldera is somewhat excentric with relation to the earlier one.

Several good-sized cones were built after the breaking down of the original volcano. One of the earlier is Gunung Abang, which surmounts the western side of the main ring wall with a summit of 2,152 meters; its western slope is moderately ravined; its eastern side was broken down by the later sinking of the deeper caldera floor. Important later eruptions produced the confluent cones of Gunung Batur proper, consisting partly of lavas but more largely of fragmental materials, in the center of the later caldera: the higher cone to the north is 1,717 meters in altitude, the lower one, 1,589 meters; each cone has a crater, and each crater wall is highest on the north. The latest lava flow came from the lower cone in 1905 and now covers a southeastern part of the lower caldera floor; but a larger part of the floor, between the central Batur cones and the Abang halfcone on the west is occupied by a crescentic lake of deep blue or green color, which adds greatly to the beauty of the view from the ring wall and makes it one of the finest volcanic panoramas in the Archipelago. The lake surface is about 7 kilometers long by 2.5 kilometers wide and has an area of 15.5 square kilometers. The water is fresh although the lake has no visible outlet; its level rises somewhat during the southwest monsoon. Hot springs occur near the lake and are reported to be of medicinal value. The Batur cones are barren, but the caldera floor and rim wall have more or less vegetation and are in part populated and cultivated.

W. M. Davis

Land Forms of Northwestern Sumatra

W. F. F. Oppenoorth and J. Zwierzycki. **Geomorfologische en tektonische waarnemingen als bijdrage tot verklaring van de landschapsvormen van Noord-Sumatra.** Map, diagrs., ills. *Jaarboek van het Mijnwezen in Nederl. Oost-Indië*, Vol. 46, 1917, Part I, pp. 276–311. Batavia.

This essay is a by-product of governmental geological surveys in Atjeh, the northwesternmost province of Sumatra. The province is 370 kilometers long, northwest-southeast, and about 100 kilometers across, with a full-length coast to the southwest, a somewhat shorter east-west coast that truncates the end of the great island obliquely, and a short northeast coast. The boundary between Atjeh and the adjoining province runs irregularly a little east of north. The essay gives gratifying evidence that modern methods of physiographic analysis are applied by competent investigators in the Dutch East Indies in a thoroughly appreciative manner. Three subdivisions of the province are recognized: (1) The high mountains of the interior, composed of schists and bedded rocks with altitudes of from 1,400 to 2,800 meters and continued southeastward; (2) a bordering hilly belt of variable width, composed of more or less folded sedimentary strata, generally of small resistance; and (3) a low and narrow coastal plain. Volcanic features are irregularly distributed over the three subdivisions.

The late mature or aging forms of a former cycle of erosion are preserved in the highlands in the interior mountains, where rounded summits maintained by the more resistant rocks rise to moderate heights over broad high-level depressions which represent subsequent valleys following belts of weaker rocks; but in consequence of a central upheaval of about 1,000 meters the broad high-level depressions are now incised by deep, early-mature valleys, in which the main rivers are generally graded and have only occasional rapids. Waterfalls are, however, still retained in the upper courses of the side streams, which descend to the main valleys between hilly spurs, the flat tops of which record the present altitude of the former broad valley floors. The upheaval of the region decreases outwards from the central mountains, for the hilly belt has altitudes of only 400 meters next to the mountains and of about 50 meters near the coast. This movement increased the size of the original island by adding some of the adjoining sea bottom to it, especially on the northeast where the added belt is broadest and uninterrupted; it is narrowest on the southwest, where some of the mountains reach the coast in bold headlands. The strata of the hilly belt are chiefly clays